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Chrysosplenium suzukaense (Saxifragaceae), a New Species from Yoro and Suzuka Mts., Central Honshu, Japan

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A new species, *Chrysosplenium suzukaense*, from the northern part of the Yoro Mountains and Suzuka Mountain Range, Central Honshu, Japan, is described. *Chrysosplenium suzukaense* belongs to ser. *Macrostemon*, and is most similar to *C. fauriei* in the *C. fauriei* group (*C. fauriei*, *C. kiotense* and *C. nagasei*) distributed on the Sea of Japan side of Japan. However, *C. suzukaense* differs from *C. fauriei* in always having four stamens opposite the calyx lobes (vs. eight stamens), and smaller stature and flowers. The distribution of C. *suzukaense* is nearer the Pacific Ocean side, but in an area of much snow in winter, showing climatic conditions similar to the Sea of Japan side. The rosette-like basal leaves retained until end of the flowering time in *C. suzukaense* and the *C. fauriei* group may be an adaptation to the Sea of Japan side environment, especially to a much snow. The chromosome number, representing the karyotype, of C. suzukaense was confirmed to be 2*n*=22, and similar to other members of the *C. fauriei* group.

Key words: *Chrysosplenium suzukaense*, new species, Saxifragaceae, Suzuka Mountain Range, Yoro Mts.

Chrysosplenium L. (Saxifragaceae) includes about 60 species of perennial herbs of moist places, especially forest floors, among rocks and along streams, from lowlands to high alpine regions. Most species occur in temperate and arctic regions of the northern hemisphere, with the greatest diversification in temperate Asia, especially in the Himalaya, China, and Japan. Eighteen species are currently in Japan, fourteen of which belong to sect. *Chrysosplenium*, the group having opposite leaves (Wakabayashi 2001).

Recently, we discovered an undescribed species of *Chrysosplenium* in the northern part of the Yoro Mts. in Gifu Prefecture and in the Suzuka Mountain Range in Gifu, Shiga and Mie prefectures, central Honshu, Japan. These plants were previously identified as *C. fauriei* Franch., based on specimens in KYO, TI, TNS, and MAK, although they are relatively small and occur somewhat isolated from the main distribution area of *C. fauriei* (Wakabayashi & Ohba 1995). To further understand these plants, we visited the native habitats several times and made field surveys and collected samples for study. As a result, we concluded that these plants were not *C. fauriei*, but a species new to science. Very recently, this same species has been reported as an unknown from Shiga Prefecture (Oda & Muranaga 2015). We describe here this new species, *C. suzukaense*, and discuss its morphological and cytological characteristics and its geographic distribution.

Materials and Methods

The plants examined in this study were collected from native populations in the northern Yoro Mts. and northern area of the Suzuka Mountain Range. Morphological observation of flowers, capsules and seeds were made from materials fixed in FAA. The fixation was carried out in the laboratory from plants collected in the field. The seeds were observed by SEM (JSM-5300, JEOL Ltd.) after dehydration in an ethyl alcohol series, replacing the ethyl alcohol with t-butyl alcohol, drying in a freeze-drying device (JFD-300, JEOL Ltd.), and coating with gold by ion-sputter (JFC-1100E, JEOL Ltd.). The root tips for cytological observation were collected from cultivated plants in the experimental garden, Makino Herbarium, Tokyo. After pretreatment with 0.002 M 8-hydroxyquinolin for 3 hr, the root tips were fixed in Newcomer's fluid at about 4℃. The fixed root tips were completely hydrated using an ethyl-alcohol series, then soaked in a 1 : 1 solution of 2 % pectolyase and 4 % cellulase for 45 min at 37℃ to macerate the cell walls and to soften the root tips. They were then stained with 2% acetic orcein for 12 hr and then squashed. For karyotype analysis, the nomenclature for centromeric position follows Levan *et al*. (1964).

Voucher specimens for these studies are in the Makino Herbarium, Tokyo Metropolitan University (MAK). To determine the distribution of this new species, we studied specimens in the herbaria of the University Museum, the University of Tokyo (TI), the Department of Botany, Faculty of Science, Kyoto University (KYO), the National Science Museum, Tokyo (TNS), the Department of Biology, Faculty of Education, Gifu University (GIFU), and MAK.

Results and Discussion

Description

Chrysosplenium suzukaense Wakab., Hir. Takah. & S. Tomita, **sp. nov.** —Figs. 1–6, 8 a–c.

Similar to *Chrysosplenium fauriei* Franch. but differing by always having four stamens opposite the calyx lobes (vs. eight stamens), and smaller flowers 1.8–2.5 mm across (vs. 2.8–3.5 mm across).

Typus. JAPAN. Honshu. Mie Prefecture: Kogurumi-dani, NE foot of Mt. Oike-dake, 500–1000 m alt., Fujiwara-cho, Inabe-shi. 3 April 2003, *M. Wakabayashi & S. Tomita 030403-1*, [holo- MAK (MAK 452873); iso- KYO, TI].

Misapplied. Chrysosplenium fauriei sensu Wakab. & H. Ohba in Acta Phytotax. Geobot. 46: 14 (1995), p. p., quoad pl. Yoro et Suzuka Mts.

Herbs, perennial. Leaves opposite. Glabrous except for brownish hairs in axils. Rhizome decayed at anthesis. Basal leaves compact, decussate, forming a rosette with few pairs of leaves, persistent and prominent until end of flowering time, decaying after flowering, nearly sessile or short petiolate; blade rounded or obovate-oblong, 10–32 mm long, 10–30 mm wide. Flowering stem developed first from shoot apex from rosette. Several flowering stems and sterile branches subsequently developing from axils of basal leaves and often from axils of cauline leaves of flowering stem. Sterile branches elongate laterally, forming a rosette at apex with 2 or 3 pairs of larger leaves; rosette leaves rounded or flabellate-orbicular, short petiolate or sessile, with 4–7 incurved low teeth on each side, upper surface green with whitish stripe along veins, lower surface whitish green, to 10–16 mm long, 10–17 mm wide after anthesis. Flowering stems 3–9 cm tall at anthesis, 6–15 cm tall in fruiting season, with 2 or few cauline leaves but lower leaves often decayed after anthesis; cauline leaves long petiolate; blade ovate to elliptic, base cuneate, 4–18 mm long, 4–12 mm wide, with 4–7 incurved low teeth on each side. Bracteal leaves around inflorescence ovate to elliptic, margin crenate, bright yellow or greenish yellow. Flowers late March to early April, apetalous, 1.8–2.5 mm across. Calyx lobes 4, slightly saccate or not saccate, ovate or triangular, erect or obliquely ascending, apex obtuse, 1.2–1.3 mm long, brownish gray or greyish with minute purple dots. Stamens 4, opposite calyx lobes, exserted beyond calyx lobes, 1.7–2.6 mm long; filaments 1.8–2.8 times longer than anthers at anthesis; anthers dark red, 0.6–0.8 mm long. Ovary inferior to 1/2 inferior. Styles 2, slender, as long as or exserted beyond calyx lobes. Capsules subsuperior, 2-lobed; lobes obliquely ascending, long exserted, somewhat unequal, persistent styles ca. 0.6 mm long; persistent filaments as long as or longer than calyx lobes. Seeds ellipsoid, 0.6–0.8 mm long, longitudinally ca. 12 costate with tuberculate ridges; tubercles on ridges dome shaped or columnar, 9–38 μm long. Chromosome number 2*n*=22.

Japanese name. Suzuka-botan.

Distribution. Japan. Honshu. Northern Yoro Mts. in Gifu Prefecture and northern part of Suzuka Mountain Range in Gifu, Shiga and Mie prefectures (from the vicinity of Sekigahara to S foot of Fujiwara-dake southward).

Other specimens examined. **Gifu Pref.** ***Yoro-gun***: Yoro – Mt. Sanpozan, *H. Takahashi et al. 6999* (MAK, GIFU); Yoro-no-taki, Yoro-cho, *M. Wakabayashi & S. Tomita 030403-8* (MAK). ***Oogaki-shi***: in the vicinity of Oku, Kamiishizu-cho, *H. Takahashi 21544* (MAK, GIFU); in the vicinity of Kawahigashi, Kamiishizu-cho, *H. Takahashi 21561* (MAK, GIFU); Tokiyama, Kamiishizu-cho, *H. Takahashi 21539* (MAK, GIFU). ***Fuwa-gun***: 1 km south of Kaido, Imasu, Sekigahara-cho, *H. Takahashi 21575* (MAK, GIFU); 500 m south of Sofu-dani, Imasu, Sekigahara-cho, *H. Takahashi 21584* (MAK, GIFU); Sofu-dani, Sekigahara-cho, *M. Wakabayashi & H. Yoshii 04050102, 04050103*, *04050105* (MAK). **Mie Pref.** ***Inabe-shi***: Sakamoto, Fujiwara-cho, *S. Yamamoto 22575* (MAK); Yamaguchi, Fujiwara-cho, *S. Tomita 020501-2* (MAK); upper streams of Inabe-gawa, Yamaguchi, Fujiwara-cho, *S. Tomita 020514-1* (MAK); Hiekawa, Yamaguchi, Fujiwara-cho, *M. Wakabayashi & S. Tomita 030402-1* (MAK); along the branch of Inabe River, Yamaguchi, Fujiwara-cho, *M. Wakabayashi & H. Yoshii 04050106* (MAK); Yamaguchi – Kurakake-touge, Fujiwara-cho, *H. Takahashi 21538* (MAK, GIFU); Aokawakyo, Hokusei-cho, *M. Wakabayashi & H. Yoshii 04050109* (MAK). **Shiga Pref.** ***Inukami-gun***: Ojigahata – Mt. Oike-dake, Taga-cho, *G. Murata & N. Fukuoka 92* (MAK, TI, KYO); *M. Wakabayashi 331* (KYO); Ojigahata, Taga-cho, *H. Takahashi 21513* (MAK, GIFU); Hozuki – Goso, Taga-cho, *H. Takahashi 21518* (MAK, GIFU); Nyudani, Ryozen, Taga-cho, *H. Takahashi 21520* (MAK, GIFU); ***Maibara-shi***: Kuregahata, *C. Hashimoto 10880* (TI), 5 May 1968, K. Nagai s.n. (KYO); Samegai, Kaminyu, *H. Takahashi 21573* (MAK, GIFU); *M. Hutoh 5583* (TNS). ***Hikone-shi***: Oori-cho, *H. Takahashi 21521* (MAK, GIFU).

Taxonomic position

According to Hara's classification (Hara 1957), *Chrysosplenium suzukaense* clearly belongs to ser. *Macrostemon* in having opposite leaves, glabrous shoots except hairs in axils of leaves, subsuperior capsules with two, unequal, ascending lobes, and seeds with tuberculate ridges. Five species, *C. echinus* Maxim., *C. macrostemon* Maxim., *C. fauriei* Franch., *C. kiotense* Ohwi, and *C. nagasei* Wakab. et H.Ohba have hitherto been known in ser. *Macrostemon* (Wakabayashi 2001). Among them, the latter three species, *C. fauriei*, *C. kiotense* and *C. nagasei*, distributed mostly on the Sea of Japan side of Honshu, Japan, have been called the *Chrysosplenium fauriei* group (Wakabayashi & Ohba 1995). One characteristic of this group is that the rosette-like basal leaves are retained until the end of flowering. *C. suzukaense* also has this characteristic (Fig. 8b), suggesting that it is nearer the *C. fauriei* group in ser. *Macrostemon*.

Flowers and capsules

In comparison with the flowers of the *Chrysosplenium fauriei* group illustrated in Wakabayashi & Ohba (1995), *C. suzukaense* is most similar to *C. fauriei* in having the stamens exserted beyond the calyx lobes (Fig. 1), but different in having smaller flowers 1.8–2.5 mm across (versus 2.8–3.5 mm across in *C. fauriei*). The most distinct difference between them is in stamen number. *Chrysosplenium suzukaense* always has four stamens opposite the calyx lobes (Fig. 1a' ; Fig. 8c, d), while *C. fauriei* has eight stamens, as in most species of the genus. This characteristic of *C. suzukaense* is only in *C. grayanum* Maxim. of ser. *Nepalensia*, and is very rare in the genus. Although flowers with four stamens sometimes or rarely occur in *C. macrostemon*, *C. tetrandrum* (Lund) Th. Fries and *C. japonicum* (Maxim.) Makino (Hara 1957), four stamens in such cases are merely representative of intraspecific variation in stamen number. In *C. suzukaense* and *C. grayanum*, on the other hand, the number of stamens is invariably four, and this number of stamens is one of the important characteristics of these two species.

The shape of the flowers at anthesis in *Chrysosplenium suzukaense* is shown in Fig. 1. In the flowers from the Gifu and Mie prefecture populations, the calyx lobes were erect, forming pot-

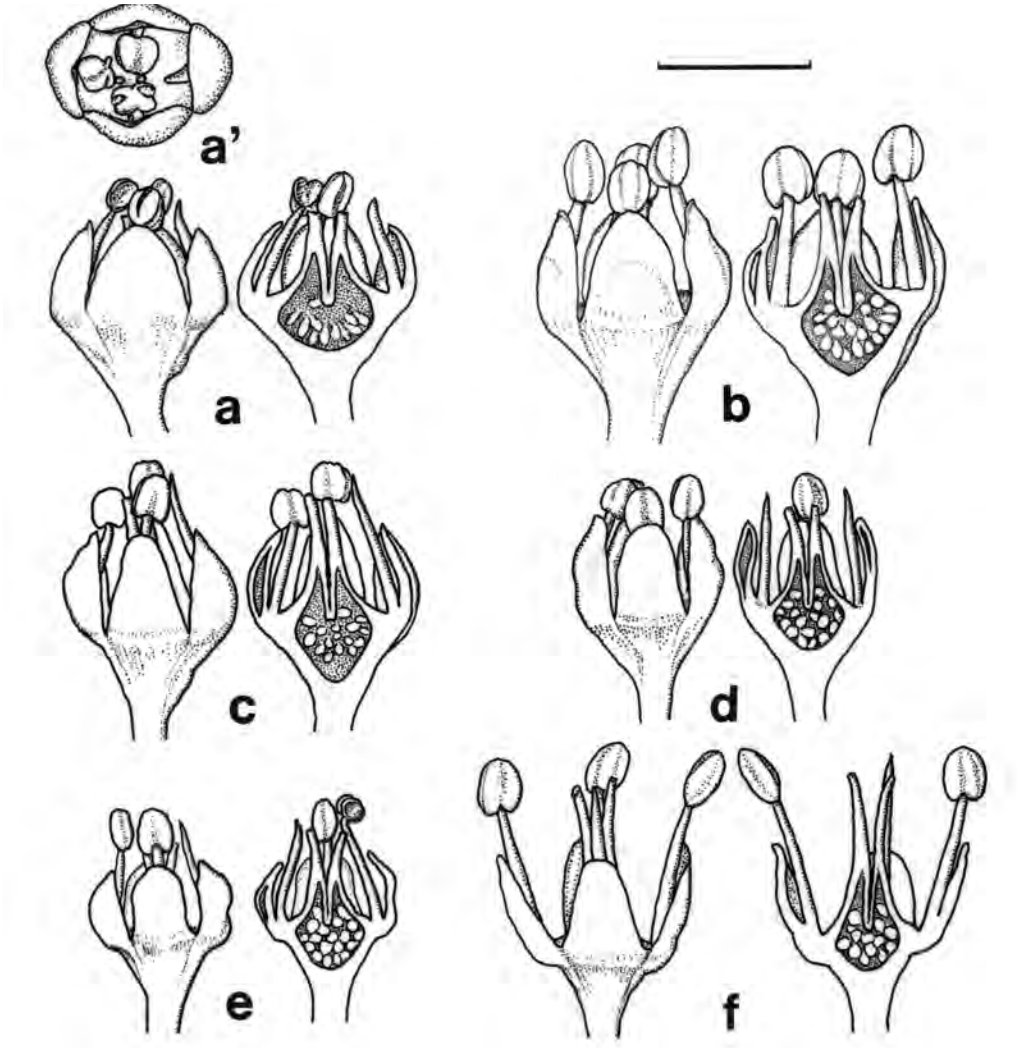

FIG. 1. Floral shape and structure of *Chrysosplenium suzukaense* at several localities; side views (left) and longitudinal sections (right) of flowers. **a’** shows top view of flower, **a**. **a**: Kogurumi-dani, Oike-dake, Mie Pref. (*M. Wakabayashi & S. Tomita 030403-1*). b: Yamaguchi, Fujiwara-cho, Mie Pref. (*M. Wakabayashi & S. Tomita 030402-1*). **c**: Yoro-no-taki, Gifu Pref. (*M. Wakabayashi & S. Tomita 030403-8*). **d**: Sofu-dani, Sekigahara-cho, Gifu Pref. (*H. Takahashi 21584*). **e**: Kamiishizu-cho, Gifu Pref. (*H. Takahashi 21561*). **f**: Samegai, Maibara-shi, Shiga Pref. (*H. Takahashi 21573*). Scale bar: 2mm.

shaped flowers (a–e), but in the plants from Samegai (Fig. 7B, arrow a) in Maibara-shi, Shiga Prefecture, the calyx lobes were obliquely ascending, forming funnel-shaped flowers (f). These observations were also made by Oda & Muranaga (2015). In stamen length, the flowers from Samegai differ from those in the other localities in Gifu and Mie prefectures. The length of the stamens from Samegai are remarkably long (Fig. 2f; ca. 2.6 mm) as compared with the plants in the Gifu and Mie prefecture populations (Fig. 2a–e; 1.7–2.0 mm). Fig. 3 shows side views of the mature capsules of *Chrysosplenium suzukaense* from several localities. Since the four persistent filaments are arranged just behind the calyx lobes, the difference in length between the persistent filament and the calyx lobes is easily observable. The filaments were as long as the calyx lobes (Fig. 3a; Kogurumi-dani, Fujiwara-cho, Mie Pref.) or slightly longer than the calyx lobes

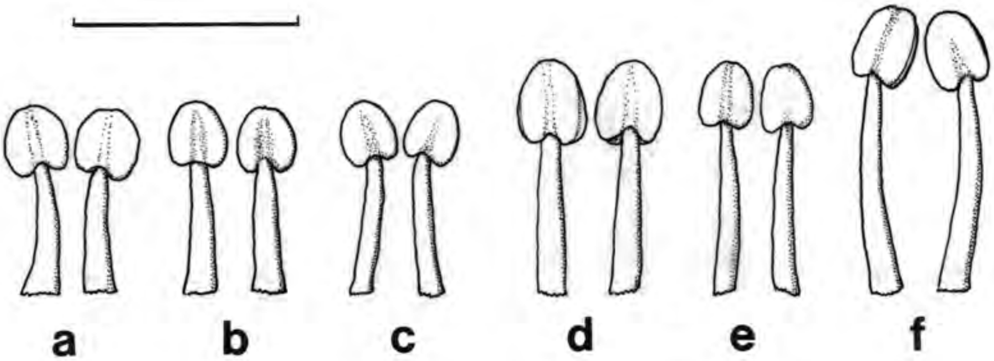

FIG. 2. Stamens just before dehiscence of anthers in *Chrysosplenium suzukaense*, showing adaxial (left) and abaxial (right) views. **a**: Kogurumi-dani, Oike-dake, Mie Pref. (*M. Wakabayashi & S. Tomita 030403-1*). **b**: Sofu-dani, Sekigahara-cho, Gifu Pref. (*H. Takahashi 21584*). **c**: Kawahigashi, Kamiishizu-cho, Gifu Pref. (*H. Takahashi 21561*). **d**: Yamaguchi, Fujiwara-cho, Mie Pref. (*M. Wakabayashi & S. Tomita 030402-1*). **e**: Yoro-no-taki, Gifu Pref. (*M. Wakabayashi & S. Tomita 030403-8*). **f**: Samegai, Maibara-shi, Shiga Pref. (*H. Takahashi 21573*). Scale bar: 2mm.

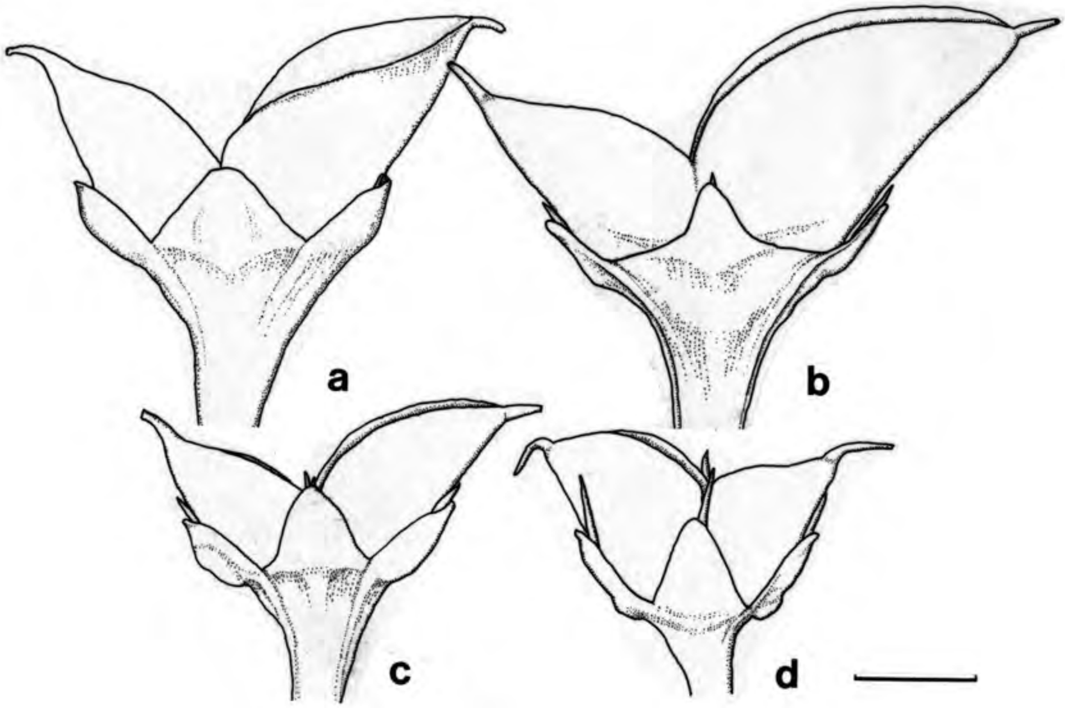

FIG. 3. Capsules of *Chrysosplenium suzukaense* from several localities. **a**: Kogurumi-dani, Oike-dake, Mie Pref. (*M. Wakabayashi & al. 030403-1*). **b**: Sofu-dani, Sekigahara-cho, Gifu Pref. (*H. Takahashi 21584*). **c**: Yamaguchi, Fujiwara-cho, Mie Pref. (*M. Wakabayashi & S. Tomita 030402-1*). **d**: Samegai, Maibara-shi, Shiga Pref. (*H. Takahashi 21573*). Scale bar: 2mm.

(Fig. 3b and Fig. 3c; Sekigahara-cho, Gifu Pref. and Yamaguchi, Fujiwara-cho, Mie Pref., respectively). In comparison, the persistent filaments on the capsules from Samegai were much longer than the calyx lobes - about 1.6 times longer (Fig. 3d). Thus, the floral shape and capsule morphology of *Chrysosplenium suzukaense* may indicate that the plants in Samegai in Shiga Prefecture are taxonomically distinct from the other populations. However, a formal taxonomic treatment of

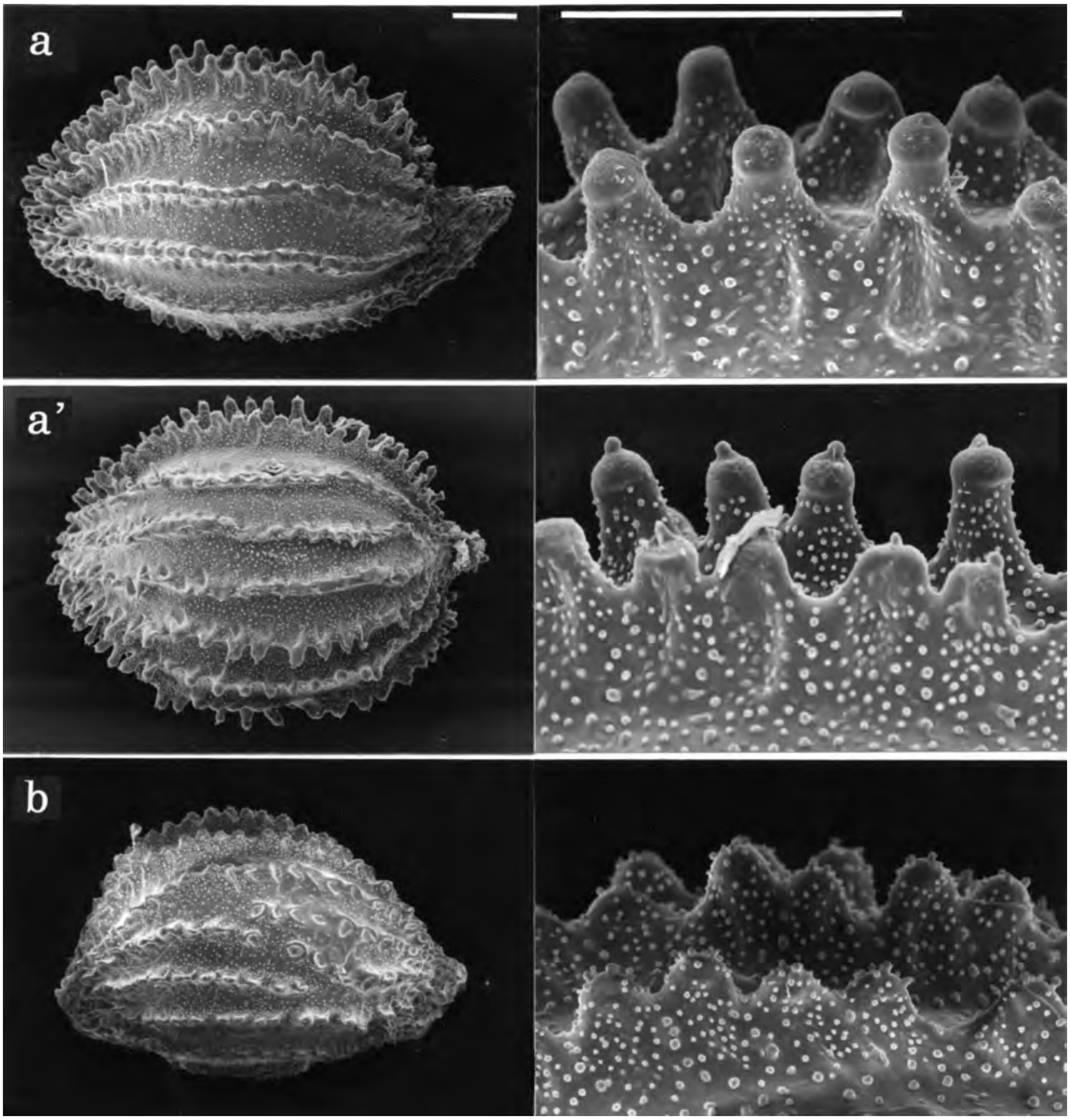

FIG. 4. Seed surface structure of *Chrysosplenium suzukaense*. **a**, **a'**: Yamaguchi, Fujiwara-cho, Mie Pref. (*M. Wakabayashi & S. Tomita 030402-1*). **b**: Kogurumi-dani, NE foot of Oike-dake, Fujiwara-cho, Mie Pref. (*M. Wakabayashi & S. Tomita 030403-1*). **a**, **b**: side view. **a'**: dorsal view. Scale bars: 100μm.

the Samegai population should be made only after examining more populations, especially in Shiga Prefecture.

Seeds

The seed surface of species in ser. *Macrostemon*, to which *Chrysosplenium suzukaense* belongs, have hitherto been observed using SEM by Kaplan & Strohschneider (1984), Kato & Shimizu (1989) and Wakabayashi & Ohba (1995). According to their photographs, the tubercles on the ridges are very long, reaching 230 μm in *C. echinus*. They are columnar, round headed and with often a minute apical protuberance and vary in length from 35 to 110 μm in *C. macrostemon*. In the *C. fauriei* group (*C. fauriei*, *C. kiotense* and *C. nagasei*) they are dome-shaped, often with a minute apical protuberance and 8 to 20 μm long.

The dome-shaped tubercles less than 20 μm long in the *Chrysosplenium fauriei* group are considered to correspond to the round headed apex of the columnar tubercles.

Fig. 4 shows the seed and surface structure of *C. suzukaense* observed by SEM from two different populations. Fig. 4a and a' show the seeds from Yamaguchi, Fujiwara-cho, Mie Prefecture, presenting side and dorsal views, respectively. The seeds are ellipsoid, 0.7–0.8 mm long, and longitudinally ca. 12 costate with tuberculate ridges. Many granules cover the whole surface, the larger of which are scattered transversely between the tubercles. The tubercles on the ridges are mostly columnar, 18 to 38 μm long, round headed with often a minute apical protuberance. This feature of the tubercles occurs in *C. macrostemon,* but not in *C. fauriei* group. Fig. 4b shows the seed from the type locality, Kogurumi-dani, NE foot of Mt. Oike-dake, Fujiwara-cho, Mie Prefecture. The seed is about 0.6 mm long and all the tubercles on the ridges are dome-like and 9 to 18 μm long. This is a feature of the *C. fauriei* group. Although more populations should be examined, it may be said that the seed surface structure of *C. suzukaense* is variable, depending on the population, in the shape of tubercles in the *C. fauriei* group and in *C. macrostemon*.

Chromosomes

The chromosome counts from eight different populations of *Chrysosplenium suzukaense* are shown in Table 1. The chromosome number of $2n=22$ was found in all the individuals examined from throughout the populations. This represents diploids with a basic chromosome number $x=11$, which is another of the characteristics of ser. *Macrostemon*. As shown in Fig. 5, the chromosomes of *C. suzukaense* are rather small, ranging from 1.3 μm to 2 μm in length at metaphase. Fig. 6 shows the karyotype, in which *st* (subterminal centromeric) chromosomes and *sm* (submedian centromeric) chromosomes are arranged in the first row, and *m* (median centromeric) chromosomes are in the second row. There are four pairs of *st-sm* chromosomes (nos. 1–4) and seven pairs of *m* chromosomes (nos. 5–11) in a set. This karyotype closely resembles those of *C. fauriei*, *C. kiotense* and *C. nagasei* (*C. fauriei* group) examined by Wakabayashi & Ohba (1995).

Geographic distribution

Based on the herbarium specimens cited above, the geographic distribution of *Chrysosplenium suzukaense* is shown in Fig. 7B. The area of distribution is limited to the northern part of the Yoro Mountains (Fig. 7A, 2) and the Suzuka Mountain Range (Fig. 7A, 1) represented by Ryozen, Oike-dake and Fujiwara-dake, which are mostly in a limestone area. Based on the specimens we examined, the northernmost locality of the area is Sofu-dani (Fig. 7B, arrow b), Sekigahara-cho, Gifu Prefecture, while the southernmost one is Aokawa-kyo (arrow c), Hokusei-cho, Inabe-shi, Mie Prefecture. The western limit is at Samegai (arrow a), Maibara-shi or the vicinity of Oori-cho (arrow d), in the eastern part of Hikone-shi, Shiga Prefecture. The eastern limit is in the vicinity of Yoro-no-taki (arrow e), Gifu Prefecture. *Chrysosplenium suzukaense* occurs nearer the Pacific Ocean side, but many plant species, for example, *Ilex leucoclada* (Maxim.) Makino, *Weigela hortensis* (Siebold & Zucc.) K. Koch, *Arnica mallotopus* (Franch. & Sav.) Makino, *Scutellaria muramatsui* H. Hara, *Cacalia nikomontana* Matsum., *Narthecium asiaticum* Maxim., etc., are mainly on the Sea of Japan side (so called, Sea of Japan elements), but also occur in the Suzuka Mountain Range (Fukuoka 1965, 1966). *Chrysosplenium nagasei* var. *porphyranthes* in the *C. fauriei* group also occurs at many localities in this area, and extends farther southward to Nonobori-yama along the Suzuka Mountain Range (Wakabayashi & Ohba 1995). There is considerable snow in winter in this area, as pointed out by Fukuoka (1965). The snowy environment in winter and the invasion of the Sea of Japan elements into this area may have been due to the northwest seasonal winds in winter that reach this area from the Sea of Japan through Lake Biwa. The rosette-like basal leaves retained until end of the flowering time, which are observed in *C. suzukaense* and in *C. fauriei* group, may be a characteristic adaptation to the Sea of Japan side environment,

TABLE 1. Chromosome numbers of *Chrysosplenium suzukaense* Wakab., Hir. Takah, & S. Tomita.

Chromosome number (2*n*)	Locality	Voucher specimen (MAK) (Collector and No.)
22	Gifu Pref.: Sofu-dani, Sekigahara-cho, Fuwa-gun	*M.Wakabayashi & al. 04050102*
22	Gifu Pref.: Kawahigashi, Kamiishizu-cho, Oogaki-shi	*H.Takahashi 21561*
22	Mie Pref.: Aokawa-kyo, Hokusei-cho, Inabe-shi	*M.Wakabayashi & al. 04050109*
22	Mie Pref.: Yamaguchi--Kurakake-toge, Fujiwara-cho, Inabe-shi	*H.Takahashi 21538*
22	Shiga Pref.: Nyudani, Ryozen, Taga-cho, Inukami-gun	*H.Takahashi 21520*
22	Shiga Pref.: Hozoki--Goso, Taga-cho, Inukami-gun	*H.Takahashi 21518*
22	Shiga Pref.: Oori-machi, Hikone-shi	*H.Takahashi 21521*
22	Shiga Pref.: Samegai, Maibara-shi	*H.Takahashi 21573*

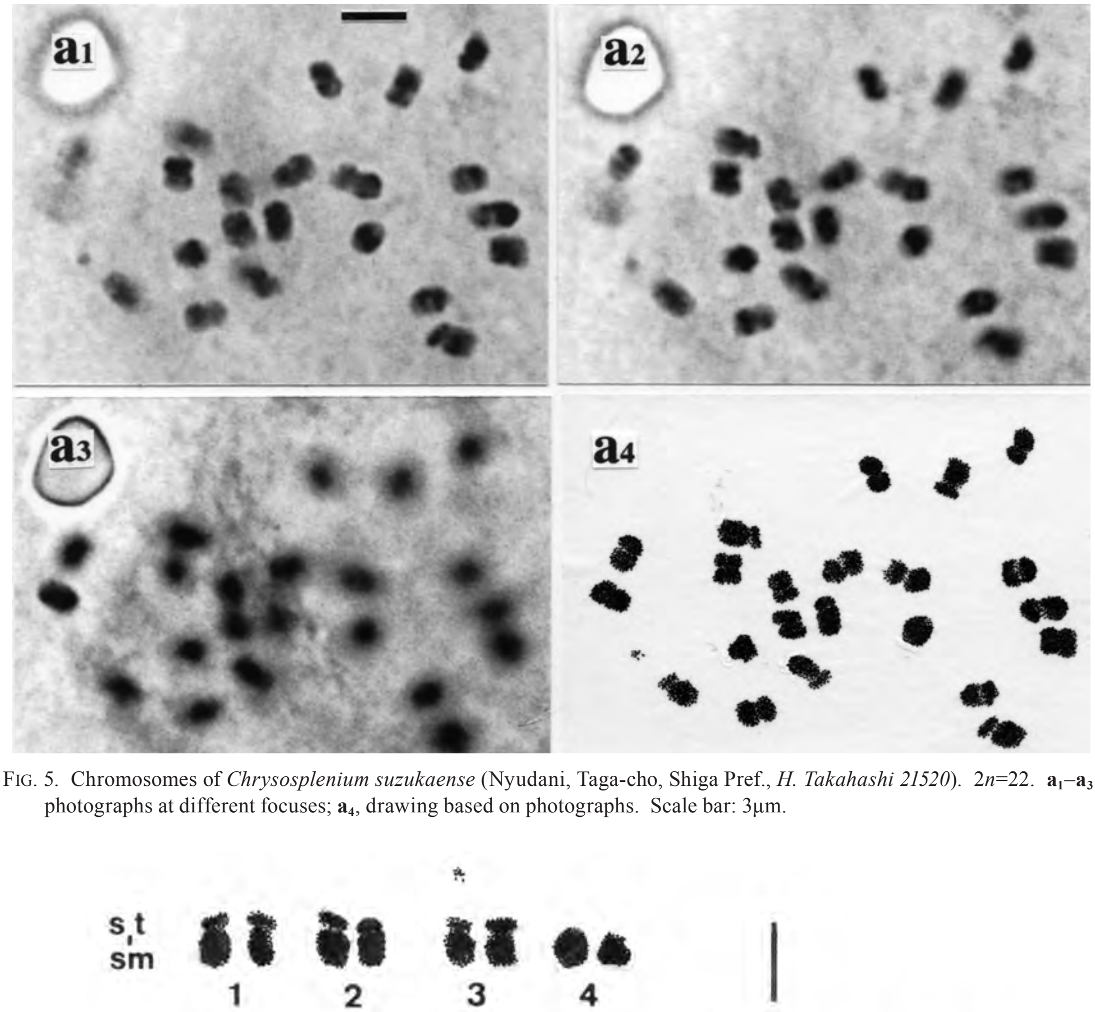

FIG. 5. Chromosomes of *Chrysosplenium suzukaense* (Nyudani, Taga-cho, Shiga Pref., *H. Takahashi 21520*). 2*n*=22. **a**$_1$–**a**$_3$, photographs at different focuses; **a**$_4$, drawing based on photographs. Scale bar: 3µm.

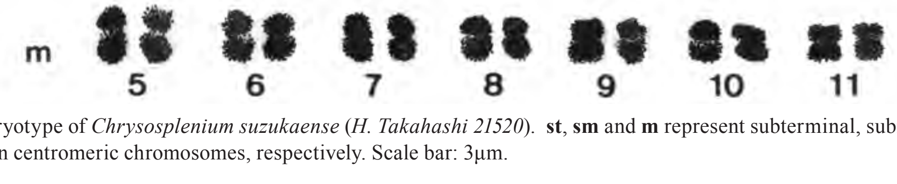

FIG. 6. Karyotype of *Chrysosplenium suzukaense* (*H. Takahashi 21520*). **st**, **sm** and **m** represent subterminal, submedian and median centromeric chromosomes, respectively. Scale bar: 3µm.

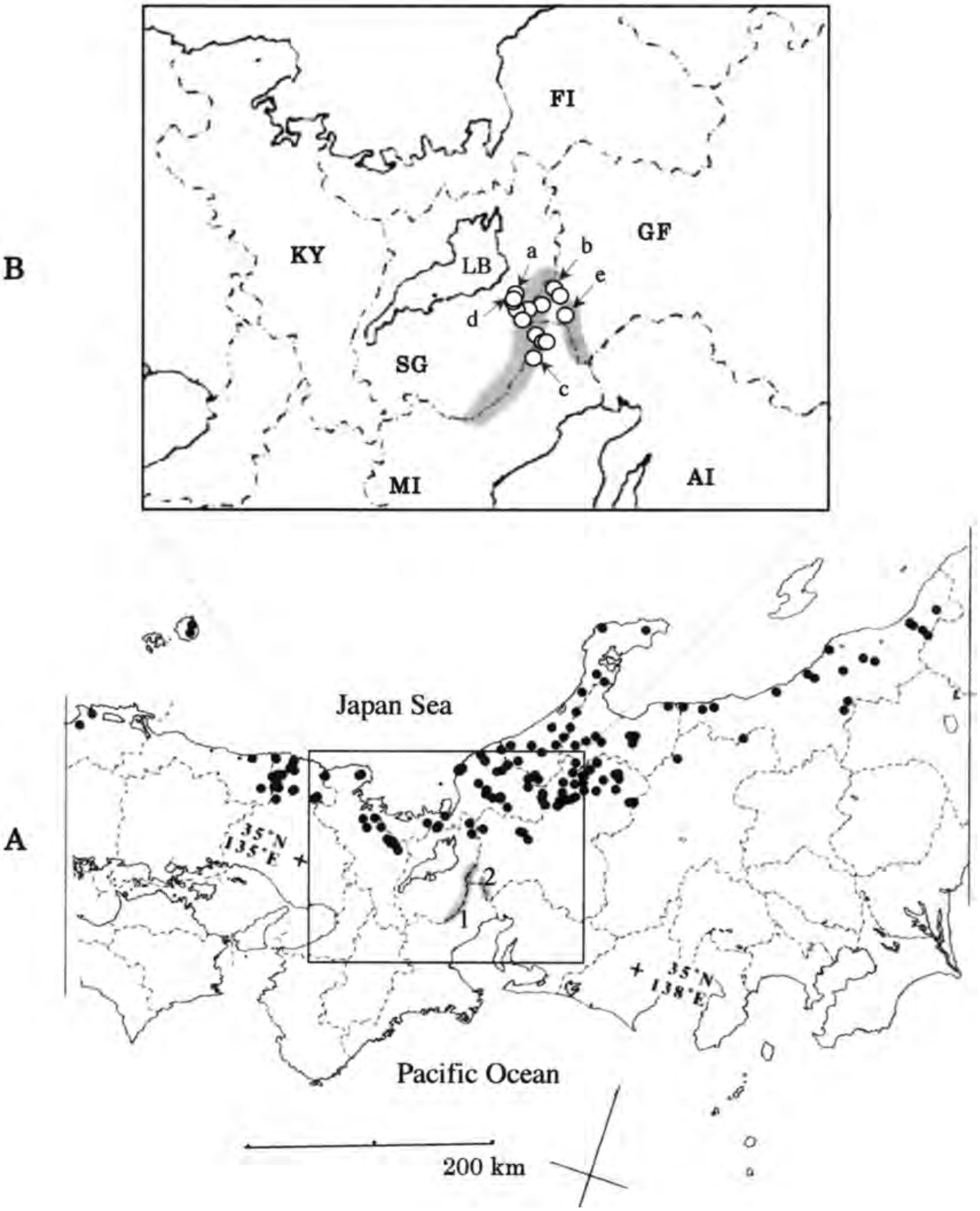

FIG. 7. Geographic distribution of *Chrysosplenium suzukaense* and *C. fauriei*. **A**: map of Central Honshu, Japan, showing location of Suzuka Mountain Range (1) and Yoro Mountains (2), where *C. suzukaense* occurs. Solid circles indicate distribution of *C. fauriei*; cited from distribution map in Wakabayashi & Ohba (1995) except for misidentified plants of Yoro and Suzuka Mts. **B**: enlarged view of part enclosed by square in A, indicating distribution of *C. suzukaense* by open circles. Arrows a, b, c, d and e show Samegai, Sofu-dani, Aokawa-kyo, Oori-cho, and Yoro-no-taki, respectively. Abbreviation LB shows Lake Biwa; SG, Shiga Prefecture; GF, Gifu Pref.; MI, Mie Pref.; FI, Fukui Pref.; AI, Aichi Pref.; KY, Kyoto Pref.

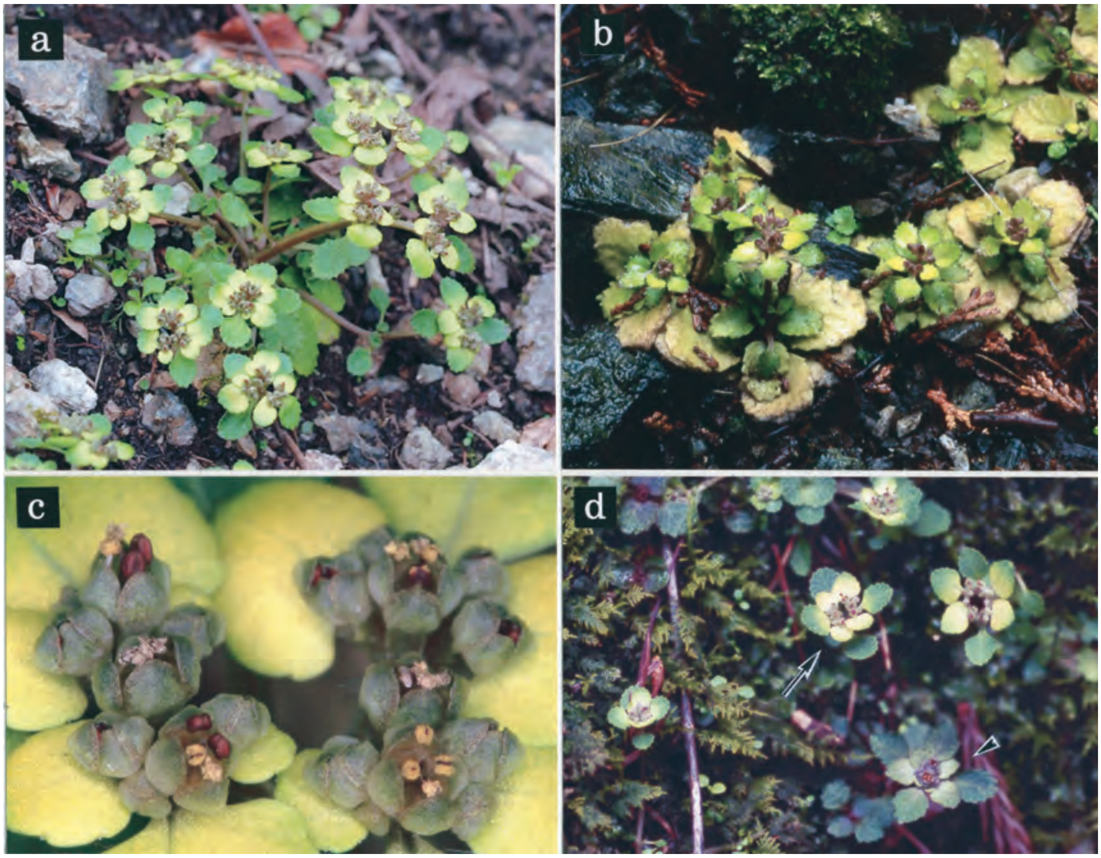

FIG. 8. Plants of *Chrysosplenium suzukaense* in the field. **a**: Plants in Kogurumi-dani, Oike-dake, Fujiwara-cho, Mie Pref.; photographed on 23 April 2008. **b**: Plants in Yamaguchi, Fujiwara-cho, Mie Pref., showing conspicuous basal leaves in rosette-like arrangement before anthesis; photograph on 2 April 2003. **c**: Flowers just at anthesis; Kogurumi-dani, Fujiwara-cho, Mie Pref., photographed on 3 April 2003, showing 4 stamens opposite calyx lobes. **d**: Sympatric occurrence of *C. suzukaense* and *C. nagasei* var. *porphyranthes* in vicinity of Yoro-no-taki, Gifu Pref. Arrow shows *C. suzukaense* and arrow head = *C. nagasei* var. *porphyranthes*.

especially to considerable snow.

Chrysosplenium suzukaense prefers shady, moist places. often on rocks and by clear mountainous streams in limestone areas. It is rather common in its distribution area, occurring at elevations between 160 and 1,000 m. Of the *C. fauriei* group considered to be closely related to *C. suzukaense*, the distribution area of C. *nagasei* var. *porphyranthes* overlaps with that of *C. suzukaense*, as stated above. They occur sympatrically on a moist, dripping slope in the vicinity of Yoro-no-taki, Gifu Prefecture, where both of them are shown just flowering in Fig. 8d. Genetic isolation seems to exist between them. We have not seen their sympatric occurrence elsewhere. The geographic distribution of *C. fauriei*, considered to be most closely related to *C. suzukaense*, is shown in Fig. 7A (from Wakabayashi & Ohba 1995) except for the misidentified plants from Yoro and the Suzuka Mts. From Figs. 7A and 7B, it is obvious that *C. suzukaense* and *C. fauriei* do not overlap, and are somewhat isolated from each other.

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